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FIRE AND EXPLOSION PROTECTION AT
COUNTRY GRAIN ELEVATORS

Address by
Hylton R. Brown
Senior Engineer
Chemical Engineering Research Division
Bureau of Agricultural Chemistry and Engineering
U. S. Department of Agriculture
Washington, D. C.



Fire Protection and Insurance Section
Association of American Railroads
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The isolated country grain elevator located along the railroad in or near a small settlement is a serious fire hazard. It is generally the largest building in the community. The seriousness of the hazard is due both to the nature of the business and the fact that local fire fighting facilities are usually totally inadequate to cope with a fire in such a large building. There are about 10,000 grain-handling plants classified as country elevators and they have a capacity of about 500,000,000 bushels. Some of these are owned by the railroads, others are owned and operated by large terminal grain companies and many are owned and operated by cooperative associations. Reports of the Farm Credit Administration indicate that there are 2,600 Farmers' Cooperative Elevator Associations with 360,000 members that do a business of \$475,000,000 a year. Practically all plants are located along railroads and many are on railroad land or adjoin railroad property.

FIRE AND EXPLOSION LOSSES

The exact number of country elevators destroyed by fire or explosion each year is not known and estimates of the amount of the loss vary considerably. The best information available indicates that last year, 1939, there were about 150 dust fires and explosions in country grain plants with a loss of about \$3,000,000. A study of the hazard has been undertaken by the Dust Explosion Hazards Committee of the National Fire Protection Association which was organized in January, 1922 and reorganized in 1926 in order to qualify as a sectional committee of the American Engineering Standards Committee, now the American Standards Association. The U. S. Department of Agriculture and the National Fire Protection Association act as joint sponsors of the committee.

SCOPE OF THE COMMITTEE WORK

The committee is entrusted with the development of methods of preventing dust explosions in connection with processes and industries producing combustible or explosive dusts, including measures for the prevention of ignition, restriction of potential damage by proper construction and arrangement of buildings, restriction of the production and escape of dust through the control of dust-producing processes and equipment, extinguishment methods, and related features. Fire prevention and extinguishing are included since dust explosions may result from fire.

WORK OF THE COMMITTEE

Eleven safety codes for the prevention of dust explosions in specific industries have been prepared by the committee and approved as American Standards. Other codes are in the course of preparation and to meet the need for some general information on dust explosion prevention suitable for industries which now have no specific codes the committee has compiled a set of general recommendations known as, "Fundamental Principles for the Prevention of Dust Explosions in Industrial Plants."

With the cooperation of the country grain elevator associations an attempt is now being made to compile a set of recommendations that will provide for proper protection against the dust explosion hazard in the thousands of small grain-handling plants scattered throughout the country. These recommendations are still in the tentative stage because of the difficulty encountered in preparing a set of rules which will be applicable and practicable in the many different types of plants now in operation. Buildings are of frame, metal, tile and concrete construction with the same wide variation in types of equipment installed. Many plants have feed grinding equipment in addition to storage facilities and frequently the operators act as distributors for feed, fertilizer, building material and farm machinery. Warehouses, corn cribs and sheds adjoin the main elevator building in many cases and all of these conditions must be considered in planning adequate protection for the plant.

Small elevators are subject to the same dangers as large ones, because all grain dusts explode under certain conditions and the problem of providing proper protection becomes one of recommending the safest procedure under operating practices peculiar to this type of plant. An analysis of fire losses in country grain elevators shows that practically all are preventable and owners and operators are urged to avail themselves of the latest information on fire prevention. In many cases a small fire may result in a dust explosion which spreads the flames throughout the building and causes a complete loss.

GENERAL PRECAUTIONS

There are certain generally accepted recommendations for fire and explosion prevention which should be adopted pending the preparation of a specific code for country elevators. Some of these recommendations are listed below:

1. Non-combustible construction is recommended.
2. Combustible elevators should be metal-clad.
3. Frame elevators of heavy crib construction are preferable to the lighter types.
4. Partitions should be of heavy construction preferably of non-combustible material.
5. Hazardous areas should be cut off with walls of heavy planks or non-combustible material.
6. Stairs and wells should be inclosed or cut off from hazardous areas.
7. Feed grinding or milling operations should be conducted in a separate building or segregated section of the plant.
8. Lodges and beams or other lodging places for dust should be eliminated.

9. Bins should be covered but vented to the outside to prevent dust dissemination throughout the house.

10. Equipment should be as dust-tight as possible.

11. Cleanliness is of prime importance and the prevention of dust accumulations is essential.

12. Large window area should be installed and cross ventilation provided wherever possible.

13. Equipment should be non-combustible and maintained in good operating condition.

14. Electricity is recommended for lighting and power with all equipment selected and installed to conform to the National Electrical Code requirements for dusty locations.

15. Only low pressure steam or similar heating equipment incapable of igniting dust clouds should be used in operating parts of the plant.

16. Protection against lightning should be provided.

17. Smoking should be prohibited.

18. Grounds around the plant should be kept clear of high weeds and rubbish which might become ignited and permit the flames to spread to the elevator.

19. Screens should be provided at points where grain is received to catch any foreign material such as stones and scrap iron.

20. Anti-friction bearings are recommended.

21. Fire extinguishers, casks and pails or similar equipment should be placed throughout the plant and maintained in good operating condition.

22. A loud alarm or some other effective means of calling for assistance in case of fire should be provided.

GRAIN DRIERS

Many small houses have recently installed grain drying equipment and special precautions should be taken to see that such apparatus is properly installed and carefully operated.

1. Driers should be placed in a separate fire-resistive division, separated from elevator or tanks by as much space as practicable.

2. Louvers, or other permanent openings where air enters or is exhausted from buildings, should be protected by substantial corrosion-resistive wire screens, not exceeding one-fourth inch mesh, to exclude sparks, birds, paper, etc.

3. Garner, hopper, or bin over drier and same under cooling section should be dust-tight and provided with effective vents to outside.

4. All grain should pass over a coarse screen immediately ahead of drier to remove cobs, paper, sticks, etc.

5. Fans should conform to the National Fire Protection Association Regulations for the Installation of Blower and Exhaust Systems for Dust Stock and Vapor Removal.¹ The requirement for nonferrous parts should apply, unless blowing only air taken from outside building through continuous tight duct.

6. Steam coils should be so designed, installed, and arranged that dust will not lodge on coils, headers, or elsewhere in casing containing same. Coil room should be separated by dust-tight partitions and floors from drying section and all other parts of drier house.

7. Spouts between the drier building and other buildings should be of metal and equipped with approved dampers.

8. Fire-heated driers.--(a) The drier furnace should be located in a fire-resistive room or division separated from the drier columns and fans and the plant proper by masonry walls with no communication except the ducts leading from furnace to the drier fans carrying products of combustion.

(b) Fire-heated driers should be provided with reliable automatic means for regulating the temperature in the drying columns, which should consist of two independent control systems consisting of:

(1) An automatic control system designed to hold the temperature within predetermined limits at the discretion of the operator; and

(2) An emergency control system which will operate when the temperature in the drying column reaches a dangerous point by permitting the entrance of cold air into the drying columns.

(3) Where such temperature controls are operated by air pressure, suitable means should be provided to stop the drier fans automatically in case of air failure caused by leaking of broken air lines or other reasons.

(c) In addition to the automatic temperature controls required in the preceding paragraphs, suitable visual thermometers should be provided. One of these should preferably be of the extension dial type with the dial located at a point near the firing end of the furnace so as to be in plain sight of the operator.

(d) The temperature control systems for fire-heated driers should be kept in proper operating condition at all times when the drier is in use.

1. Obtainable from the National Fire Protection Association, 60 Battery-march St., Boston, Mass.

(e) When coal or coke is used as fuel for fire-heated driers, due consideration should be given to the proper storage of these fuels and the disposal of their ashes. When gas is used as the fuel, it is important that the piping system be properly installed with tight joints to prevent leakage. In addition to the gas control valves located at the drier furnace, there should be provided an additional valve outside of the buildings in an accessible place to permit shutting off the gas supply to the furnace in case of emergency. When oil is used for fuel, oil burner and fuel storage tanks used in connection therewith should be of approved type and equipped with approved control equipment.

DUST COLLECTION AND REMOVAL

Regulations which prohibit the application of suction before weighing grain entering an elevator prevent the elevator operator from providing adequate protection. It will be necessary to install effective dust collecting and dust control equipment in grain elevators before progress in dust explosion control in this industry comparable to that in milling plants can be made.

To provide effective dust control it is necessary to: (1) prevent the formation of dust clouds by applying suction at the point where the dust is produced; (2) remove all dust accumulations promptly; and (3) provide thorough ventilation for building and equipment.

Many small elevator operators feel that they cannot afford to install dust control equipment, but it is well to remember that a dust-free mill or elevator is explosion proof and the installation of an effective dust collecting system will provide protection against a hazard capable of causing the complete destruction of the plant.

In order to obtain the best information possible on desirable protective measures for country elevators an advisory committee consisting of:

Capt. L. C. Webster, Minneapolis, Minn.
J. F. Moyer, Dodge City, Kansas
Fred Sehl, Indianapolis, Ind.
Ted Brash, Spokane, Wash.

has been appointed by the country elevator associations to assist in preparing a dust explosion prevention code. This committee will present their recommendations to a subcommittee of the Dust Explosion Hazards Committee consisting of:

Hylton R. Brown, Washington, D. C.
Eugene Arms, Chicago, Ill.
G. R. Hurd, " "
K. H. Parker, " "
Capt. L. C. Webster, Minneapolis, Minn.

In this way it is planned to get into the code the information which will permit the operator or owner to provide the desired protection against the

fire and explosion hazard at his plant. Any specific recommendations which it is felt should be included in the code should be submitted to the advisory committee or directly to the Dust Explosion Hazards Committee. Such suggestions will be appreciated and through the cooperation of all interested parties it will be possible to prepare a workable, acceptable code which will effectively protect the small country grain-handling plant against the fire and dust explosion hazard.

